similar to that of those from ordinary air. *Fifth*, the state of filthiness of a sewer seems to have no perceptible effect on the number of micro-organisms. *Sixth*, the view that the micro-organisms in sewer air chiefly come from outside, is in perfect agreement with what is known as to the distribution of bacteria in air. *Seventh*, results obtained in the laboratory with an experimental sewer prove that the micro-organisms present in air are diminished to nearly one-half in passing along a moist tube 5 feet long and $1\frac{3}{4}$ inch in diameter at a rate of nearly 1 foot per second. Although most of the micro-organisms in sewer air come from outside, yet there was distinct evidence of their occasional dissemination from the sewage itself. This is the case when splashing occurs, owing to drains entering the sewer at points high up in the roof. It is, therefore, of great importance that drains should be so arranged as to avoid splashing as much as possible.

In view of the fact that ordinary sewer air is to all appearance comparatively innocent as regards its micro-organisms, experiments were also made to see whether it contained any poisonous volatile base of the nature of a ptomaïne. These experiments so far as they went had negative results.

Experiments as to the efficacy of ordinary water traps in preventing the escape of sewer gas into houses confirmed and extended the results previously obtained by Fergus.

Though the authors do not discuss the effect of the inhalation of sewer air on health, yet the results of the above investigation are clearly such as to make one much more suspicious as to supposed evidence of the bad effects of ordinary sewer air (at least when not vitiated by splashing), such as that examined by them.

XVIII. "On the Composition of Water by Volume." By ALEXANDER SCOTT, M.A., D.Sc. Communicated by Lord RAYLEIGH, D.C.L., Sec. R.S. Received May 23, 1887.

In 1805 Gay-Lussac and Humboldt published their classical researches on the composition of the atmosphere, and to them we are indebted for our knowledge of the proportion by volume in which hydrogen and oxygen combine to form water. Without this knowledge the determination of the relative densities of the two gases would be of no use in fixing or checking their atomic weights. This is often overlooked, and Avogadro's law taken as absolutely true for these gases at ordinary temperatures and pressures. That this cannot safely be assumed is conclusively proved by the researches of Regnault, Amagat, and others on the effects of change of temperature and pressure upon them. Not only do they not follow Boyle's law as usually

understood, but their deviations from it are in opposite directions; hence it can only be by the merest chance that at our ordinary temperatures and pressures the combining volumes should be exactly two of hydrogen to one of oxygen. Moreover, when we consider that it is more than eighty years since these researches were carried out, that the instrument used in all the measurements was Volta's eudiometer, and that the gases were collected and measured over water and so contained impurities to the extent of 0·4 per cent. in the oxygen and 0·6 to 0·8 per cent. in the hydrogen used, a redetermination of this ratio with the greatly improved means for attaining accuracy now at our command seemed to be of extreme importance. The exact ratio as given in the memoir referred to is 199·89 volumes of hydrogen to 100 volumes of oxygen, and this the authors say is almost exactly as 2 : 1.

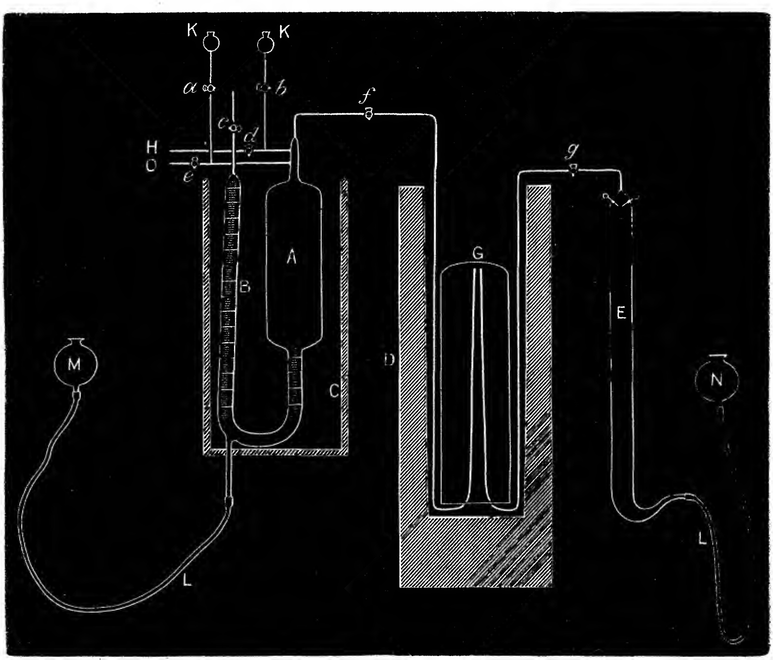
To arrive at greater accuracy the author of this note has given especial attention to the following points:—

(1.) The preparation of purer gases.

(2.) The use of larger volumes.

(3.) The measurement of both gases in the same vessel.

(4.) The analysis of the residue after explosion and determination of the impurity in each experiment.



These ends were more or less satisfactorily attained by the use of the apparatus employed, which was entirely of glass with the exception of the junctions at H and O. The gas generators contained only small volumes of gas, and could easily be exhausted by means of the apparatus itself. It is evident that by filling A and B with mercury, completely closing all the stopcocks, and then lowering M and opening *e*, the air in the oxygen generator would be in great part drawn into A; on now closing *e* and raising M this air could be expelled by opening *f*. By repeating this several times an almost perfect vacuum could be produced. Before collecting the gas for the experiments, after exhausting the air gas was evolved and exhausted, and this again repeated. The gases were measured saturated with moisture, and after measurement were expelled into G; from this they were drawn into E and exploded, and the residue measured in a small tube and analysed by explosion with either hydrogen or oxygen as required. The results of every experiment made are given in the following table, from which it will be seen that in no case, even when the maximum value is given to it, does the ratio exceed 2 vols. of hydrogen to 1 vol. of oxygen, although in four cases it is exactly 2 : 1.

The mean of the twenty-one experiments gives the ratio—

1·9857 : 1 from Column E.
1·9941 : 1 „ F.

Excluding experiments IV and VI, in which the gases contained much impurity, we get the ratio—

1·9897 : 1 from Column E.
1·9959 : 1 „ F.

Taking experiments I, III, XV, and XVIII, in which the purest gases were used, we get—

1·9938 : 1 from Column E.
1·9964 : 1 „ F.

or taking experiments I, III, XIV, XV, XVIII, and XX we get—

1·9938 : 1 from Column E.
1·9967 : 1 „ F.

Taking as the most probable ratio 1·994 : 1, and the density of oxygen referred to hydrogen as 15·9627, we get the atomic weight of oxygen as 16·01.

The oxygen was in each of the first twenty experiments prepared from potassium chlorate, and in the twenty-first from mercuric oxide

Experiment.	A. Measured volumes of		B. Residue after explosion.				C. Combining volumes, impurity being calculated as being in both in same proportion.		D. Combining volumes, all impurity being supposed to be in the oxygen.		E. Calculated from column C, 1 volume of oxygen combines with the following vols. of hydrogen.	F. Calculated from column D, 1 volume of oxygen combines with the following vols. of hydrogen.	G. Impurity in gas used (total).
	Hydrogen.	Oxygen.	Total.	Oxygen.	Hydrogen.	Impurity $N + CO_2$.	Hydrogen.	Oxygen.	Hydrogen.	Oxygen.			
I	3757·1	1919·5	39·5	36·8	—	2·7	3755·3	1881·8	3757·1	1880·0	1·9956	1·9984	$\frac{1}{2134}$
II	3848·1	2028·7	104·4	94·5	—	9·9	3841·5	1930·9	3848·1	1924·3	1·9894	2·0000	$\frac{1}{618}$
III	3902·0	2085·7	131·3	128·7	—	2·6	3900·3	1956·1	3902·0	1954·4	1·9934	1·9965	$\frac{1}{2410}$
IV	3672·6	1921·9	63·4	35·0	—	28·4	3653·7	1877·4	3672·6	1858·5	1·9460	1·9760	$\frac{1}{202}$
V	3841·5	1915·7	44·1	—	32·7	11·4	3801·2	1911·9	3808·8	1904·3	1·9882	2·0000	$\frac{1}{530}$
VI	3667·9	1868·8	56·9	—	28·1	28·8	3620·6	1857·2	3639·8	1840·0	1·9494	1·9781	$\frac{1}{201}$
VII	3685·9	1876·5	22·2	12·8	—	9·4	3679·6	1860·6	3685·9	1854·3	1·9776	1·9877	$\frac{1}{600}$
VIII	3649·1	1891·5	61·1	52·8	—	8·3	3643·6	1835·9	3649·1	1830·4	1·9846	1·9936	$\frac{1}{683}$
IX	3942·6	1997·0	18·8	12·5	—	6·3	3938·4	1982·4	3942·6	1978·2	1·9867	1·9930	$\frac{1}{949}$
X	3861·3	1967·3	30·5	24·5	—	6·0	3857·3	1940·8	3861·3	1936·8	1·9875	1·9936	$\frac{1}{983}$
XI	3799·7	1930·2	29·1	23·4	—	5·7	3795·9	1904·9	3799·7	1901·1	1·9927	1·9986	$\frac{1}{1016}$
XII	3857·1	1948·2	19·4	15·2	—	4·2	3854·3	1931·6	3857·1	1928·8	1·9954	2·0000	$\frac{1}{1394}$
XIII	3845·4	1954·9	25·0	20·5	—	4·5	3842·4	1932·9	3845·4	1929·9	1·9880	1·9926	$\frac{1}{1275}$
XIV	3780·4	1907·4	12·2	9·0	—	3·2	3778·3	1897·3	3780·4	1895·2	1·9910	1·9950	$\frac{1}{1789}$
XV	3898·6	1963·5	10·9	8·8	—	2·1	3897·2	1954·0	3898·6	1952·6	1·9945	1·9966	$\frac{1}{2801}$
XVI	3910·2	2003·2	44·9	40·4	—	4·5	3907·2	1961·3	3910·2	1958·3	1·9920	1·9969	$\frac{1}{1336}$
XVII	3965·5	2011·5	25·6	21·6	—	4·0	3962·9	1988·6	3965·5	1985·9	1·9928	1·9968	$\frac{1}{1511}$
XVIII	4012·6	1975·9	79·3	—	77·2	2·1	3934·0	1975·2	3935·4	1973·8	1·9917	1·9940	$\frac{1}{2887}$
XIX	4078·7	1964·0	184·7	—	178·2	6·5	3896·1	1961·8	3900·5	1957·4	1·9860	1·9926	$\frac{1}{945}$
XX	4095·3	2008·6	87·8	—	84·5	3·3	4008·6	2007·5	4010·8	2005·3	1·9968	2·0000	$\frac{1}{1928}$
XXI	3904·8	1964·5	27·8	—	12·5	15·3	3882·1	1959·4	3892·3	1949·2	1·9813	1·9968	$\frac{1}{394}$

The unit volume taken is that of a gram of mercury at 16° C. The gaseous volumes are reduced to 0° C. and 760 mm. pressure. The residue given in B was in all cases analysed by explosion with H or O. Column C gives the combining volumes if we assume the hydrogen and oxygen to be equally pure. Column D of course gives a maximum value to the ratio of the volume of hydrogen combining with 1 of oxygen. The gaseous impurity was almost entirely nitrogen with small quantities of carbon dioxide.

prepared from the nitrate. The hydrogen was in each case prepared by electrolysis. The water produced was free from any acid reaction, and no trace of the oxides of nitrogen could be detected.

XIX. "On Muscle Plasma." By W. D. Halliburton, M.D., B.Sc., Assistant Professor of Physiology, University College, London. Communicated by Prof. E. A. Schäfer, F.R.S. (From the Physiological Laboratory, University College, London.) Received May 24, 1887.

The facts described by Kühne relating to the properties of the muscle plasma of cold-blooded animals are true in great measure for that of mammals.

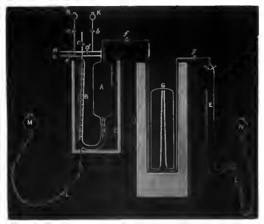
Admixture of muscle plasma with solutions of neutral salts prevents the coagulation of the latter. Dilution of such salted muscle plasma brings about coagulation; this occurs most readily at 37—40° C. Saline extracts of rigid muscle differ from salted muscle plasma in being acid, but resemble it very closely in the way in which myosin can be made to separate from it; myosin in fact undergoes a recoagulation. This is not a simple precipitation; it is first a jellying through the liquid; the clot subsequently contracts, squeezing out a colourless fluid or salted muscle serum. This does not take place at 0° C.; it occurs most readily at the temperature of the body, and is hastened by the addition of a ferment prepared from muscle in the same way as Schmidt's ferment is prepared from blood. The ferment is not identical with fibrin ferment, as it does not hasten the coagulation of salted blood plasma; nor does the fibrin ferment hasten the coagulation of muscle plasma. The recoagulation of myosin is also accompanied by the formation of lactic acid.

The proteids of muscle plasma are—

1. Paramyosinogen, which is coagulated by heat at 47° C.
2. Myosinogen,* which is coagulated at 56° C.
3. Myoglobulin, which differs chiefly from serum globulin in its coagulation temperature (63° C.).
4. Albumin, which is apparently identical with serum albumin α, coagulating at 73° C.
5. Myo-albumose; this has the properties of deutero-albumose, and is identical with, or closely connected to, the myosin ferment.

The first two proteids in the above list go to form the clot of myosin; paramyosinogen is, however, not essential for coagulation; the three last remain in the muscle serum.

* It is on the presence of this proteid that the power of fresh muscle juice to hasten the coagulation of blood plasma depends.



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